Nobuo HIRAMATSU*: **Observation on *Nostoc ellipsosporum* with special reference to the akinete**

平松信夫*: ***Nostoc ellipsosporum*** の観察，特にそのアキネートについて

The present alga grows on the wet rocks by fountainhead usually with the akinete but I have never seen the paper on full observation of this species based on the Japanese material.[1-6] I will here make a report on my observation of materials from the river-bank of Konoura, the Nishisonogi Peninsula, Nagasaki Pref., west Japan.

Diagnoses of the filaments Strata are olive brown, soft gelatinous, several mm thick, without outer covers. Filaments along outside the thallus are extremely intricate and have pale yellow sheaths which grow gradually colourless towards the inside, and finally they disappear completely. Sheaths are thick and homogenous. Each filament containing a trichome reach up to 20 μ in diameter. The cells of the trichome are 2.8-4.5 μ in diameter, long-cylindrical or cylindrical, sometimes spindle shaped in senility, 7-21 μ in length, blue green, homogenous or finely granular in protoplasm. Heterocysts are cylindrical, ellipsoidal or obtuse conical, 4.5-7 μ in length, usually situated at both ends of the trichomes, sometimes at one end only, but now and then there are none. In some cases several heterocysts can be found in the middle of a trichome. For instance, a trichome without akinete has 460 cells, and six heterocysts were found at both ends, and four at nearly regular intervals (Fig. 1: 1, 2 and 3).

Position and number of akinetes The trichomes containing akinetes have longer cells and finer granules as compared with those without akinetes, and they have the dead cells at their both ends, in addition, two heterocysts are found in succession. These last mentioned transformations may have been the result from maturation. The akinete in a trichome sometimes makes chain from one end to the other, but in many cases, leaves successively the vegetative cells and heterocysts at both terminals of a trichome. A chain of the akinete is very often divided into many chains by several intervening vegetative cells. It seems that the akinetes

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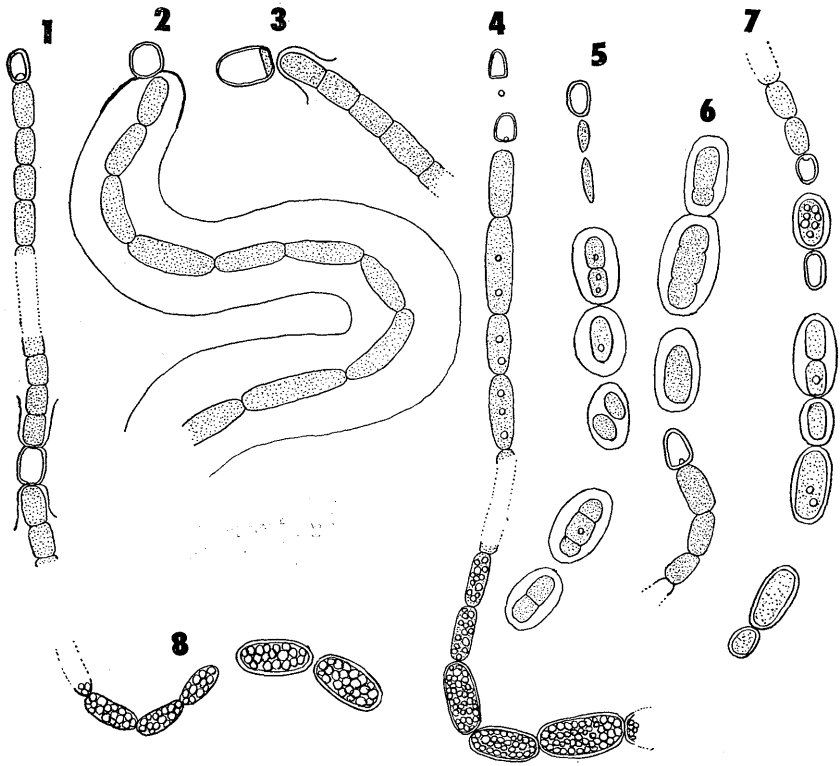


Fig. 1. 1 and 3. Sheathless filaments. 2. Sheathed filaments. 4-8. Akinetes formed on trichomes. ×445.

commonly develope out of the cells kept away from or sometimes connected to a heterocyst. According to my investigation with 50 trichomes, connected akinetes were found from 6 to even 82 at maximum number, but in most cases chain of 10 to 35 are observed, the average being 23. In general, however, they are disjuncted from one another eventuary (Fig. 1: 4-8 and Fig. 2).

Development and germination of akinetes According to my observation making comparison with many akinetes in various stages of development, the development and germination of them may be explained as follows:

1) The cell increases in length and breadth, especially in diameter of the central part. It begins to contain more granules in the protoplast, and the cell wall soon begins to separate itself from the protoplast (Fig. 3: 1).

2) The former cell wall is utterly separated from the protoplast and forms the outer investment of akinete, in the meantime the protoplast makes new cell wall, thus the akinete completes its final form and then enters in a resting period (Fig. 3: 2).

3) The wall of akinete grows from cylindrical up to be ellipsoidal in shape as a whole. Extending in the length, the protoplast is separated itself from the outer investment of akinete and shows the beginning of division. At this stage, the granules in the cell generally disappear and become to be homogenous, but sometimes they remain intact (Fig. 3: 3)

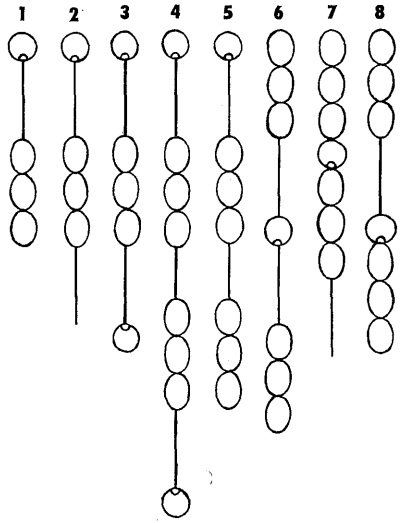


Fig. 2. Showing the position of the akinetes in trichomes. A circle with a small semicircle inside: Heterocyst. A bold line: Series of vegetative cells. An elliptic circle: Akinete.

4) The first cell-cleavage is performed to produce two cells in an akinete. These two cells remain generally connected with each other, but sometimes they are separated entirely from each other. The akinete situated at the end of a trichome often grows to undertake a pear-like form (Fig. 3: 4).

5) Three cell-stage is induced from the non-synchronized cleavage of the two newly born cells (Fig. 3: 5).

6) Four cell-stage. As the cells repeat the cleavage, the trichome gradually bends and the whole shape of akinete becomes roundish. At this stage, the wall of the akinete often breaks down and release a trichome (Fig. 3: 6).

7) A trichome ceases to grow at about the five-cell stage when the heterocyst is first formed at one or occasionally at both ends of the trichome. But sometimes the heterocysts are not formed before the release of a trichome (Fig. 3: 7 and Fig. 4).

8) Six to seven-cell stage. The akinete swells to be a large ellipsoidal mass, and becomes locally thicker or thinner by its degree of dissolution of the investment. It is usually hyaline and homogenous within the investment, but occasionally contains several small granules which seem to be degraded or secreted from cells (Fig.

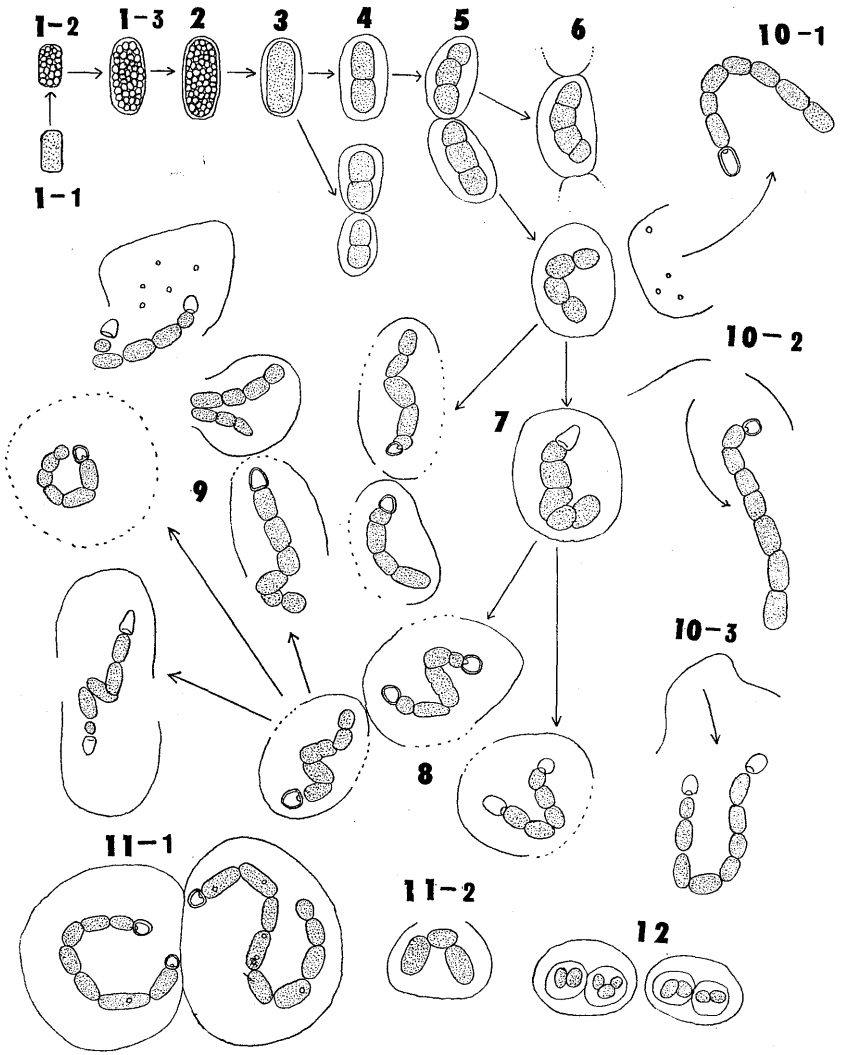
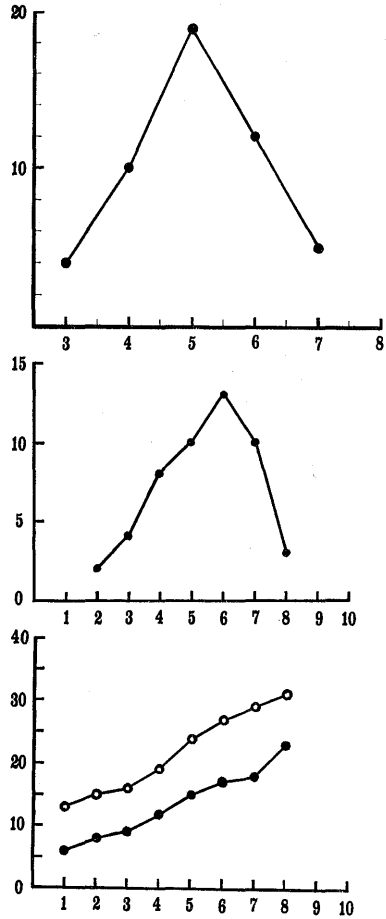


Fig. 3. 1-10. The development and germination of akinete. 11. The extremely earlier or later cases of the break of the investment. 12. New investments of the newly born cells inside the heterocysts. ×445.

3: 8 and Fig. 5).

9) The breaking of the investment releases a trichome. The breaking takes place variously as follows. a) at one spot on a free lateral side, b) simultaneously around the lateral wall, c) at the wall linked to the next akinete, d) around the whole investment simultaneously, etc. The commonest of all is the case of a) so that usually the trichome is broken into two to go out of the investment headed by a broken crease (Fig. 3: 9 and Fig. 6).

10) As the investment disappears, the trichome gradually extends itself. In the rare case, the breaking does not occur until to eight or more-cell stage, or it occurs as early as at the three-celled stage. In the rare case, it may be added that groups of two or three cells are formed within akinete, and covered by the common investment (Fig. 3: 10, 11, 12).



Figs. 4-6. 4. The distribution curve of the developmental stage of trichome to form a first heterocyst in a young trichome. Number of trichome cells in an akinete (on horizontal axis) and number of akinetes in the parent trichome when the first heterocysts are formed in a young trichome (on vertical axis). 5. The relationship between the diameter of akinetes and the number of cells included. Number of cells included in an akinete (on horizontal axis) and diameter of the akinete (on vertical axis). 6. The distribution curve of the stage of akinete to release a trichome. Number of trichome-forming cells in the akinetes (on horizontal axis) and number of akinetes which release young trichomes (on vertical axis).

Literature

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Nostoc ellipsosporum の観察をした。

1) アキネートの形成される位置は様々であるが，トリコームの両端に異質細胞と栄養細胞を残して，その中央部に連る場合が多い。

2) アキネートと異質細胞は連接することもあるが，離れている場合が多い。

3) 連接するアキネートの数は最高82個のものが見られたが，多くは10～35個の範囲である。

4) アキネートの発芽状況。 A）アキネートは発芽に近づくにつれ容積を増大し，円筒形のものが次第にまるみを帯びてくる。そして膜が融解する頃には長径25～30 μ，短径15～25 μになる。 B）アキネートが発芽して多くは5細胞の頃，異質細胞が作られる。C）異質細胞ができて間もなく，即ち多くは6細胞の頃，膜がとけてトリコームは外に出る。D）アキネートの膜の崩解は，始め自由側面の一ケ所でおこり，中のトリコームは二つ折りの状態で，折れた所で切れながら，外へ出ることが多い。

○Mitrephora Harai について（大橋廣好）Hiroyoshi OHASHI: A note on a specimen referable to *Mitrephora Harai* Ohashi in the Central National Herbarium (CAL), Calcutta

1966年 Flora of Eastern Himalaya (H. Hara) の中でバンレイシ科の新種を *Mitrephora Harai* として発表した。直径 4–5 cm の美しい花をつける低木であるが，このように目立つ植物が，シッキムのようなかなりよく調査された地域で未記録なことを不審に思っていた。1967年，インドの Central National Herbarium を訪れる機会にめぐまれたので，本種について調べてみた結果，同腊葉館でこの科を専攻している Miss D. Das の助力もあって，標本を一枚だけ発見できた。それは Kari 1145 で，Sikkim, Mausong (Muusong), 3000 ft. (1909年4月24日採) で得られたものであり，*Uvaria Hamiltonii* と同定されているものであった。これも holotype と同じく若い時期のものであるため，成葉や果実をつけていないので，原記載を補足できないのが残念であるがよい標本であったので写真を東大の標本室に入れておいた。

Mitrephora Harai Ohashi in Fl. East. Himal. 97, pl. 5 b, fig. 14 (1966)—"*Uvaria Hamiltonii*" in sched. (CAL-551287), non Hook. f. et Thoms.

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